



A.D. 1872, 21st DECEMBER. N° 3882.

Treating Excreta for Conversion into Manure.

LETTERS PATENT to William White Fereday, of No. 5, Falmouth Road, Dover Road, in the County of Surrey, Civil Engineer, for the Invention of "IMPROVEMENTS IN TREATING HUMAN EXCRETA AND IN APPARATUS FOR WORKING THE EXCRETA AND CONVERTING THE SAME INTO A DRY AND HIGHLY CONCENTRATED MANURE."

Sealed the 18th February 1873, and dated the 21st December 1872.

PROVISIONAL SPECIFICATION left by the said William White Fereday at the Office of the Commissioners of Patents, with his Petition, on the 21st December 1872.

I, WILLIAM WHITE FEREDAY, of No. 5, Falmouth Road, Dover Road, 5 in the County of Surrey, Civil Engineer, do hereby declare the nature of the said Invention for "IMPROVEMENTS IN TREATING HUMAN EXCRETA, AND IN APPARATUS FOR WORKING THE EXCRETA AND CONVERTING THE SAME INTO A DRY AND HIGHLY CONCENTRATED MANURE," to be as follows:—

This Invention has for its object improvements in treating human 10 excreta, and in apparatus for working the excreta and converting the same into a dry and highly concentrated manure.

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The solid and fluid excret as they accumulate I treat from time to time with such deodorants, being ammonia fixers, as are suited to the fertilizing purposes of the manure and the organism and development of plants.

The apparatus which I have designed is for the purpose of manufac- 5
turing the prepared solid and fluid excreta into a dry portable manure,
having all the fertilizing powers which the bulk had before being
reduced. It consists of a brick-built cemented chamber, called the
stowage chamber, fixed at such a level as will admit of the vehicles
which convey the collected excretæ depositing their contents through a 10
shoot into it. On the top is constructed a brick, lead, or iron purifying
cistern to receive charcoal or any other substance or matter being an
absorbant or destructive agent. Through the bottom a small pipe
discharges any rain water which the cistern may receive, and there is a
vapours ascension pipe rising three inches above the bottom, having its 15
outlet into it and communicating with the stowage chamber. There is
also a junction for a feed pipe, fitted with a valve or cock near the
bottom of the stowage chamber, to which when the feed pipe is attached
it communicates with the drying chamber.

The drying chamber is a stationary wrought-iron chamber, constructed 20
and permanently fixed inside a stationary wrought-iron boiler, built and
incased in fire-brick, which boiler is fitted with safety valve, steam
gauge, water indicator, supply and waste pipes for steam and water, and
such other appliances as may be necessary to fit the same as a perfect
steam boiler. 25

The boiler has one or more fire-grates. The drying chamber at its
end furthest from the fire-place or places is not enclosed within the
boiler, but is exposed, and in it is a doorway for emptying the contents
of the chamber when dried. The doorway is fitted with a loose hanging
door, which during the process of drying is closely and securely bolted 30
down on to a finely tempered clay luting flush with the furnace end.
It has a feed pipe and a tube to admit an instrument for testing from
time to time the drying of the contents of the chamber; also three
steam ascension pipes of large dimensions, one in the middle and one
near to each end, all of which rise from its top, and pass through the 35
top of the boiler. The feed pipe communicates with the stowage
chamber,

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The tube to admit the testing instrument rises a few inches above the outside of the boiler, and is fitted with a screw cap. It has as well an agitator or stirrer fixed along its centre, extending from end to end, which is kept continually in motion by steam power.

5 The three steam ascension pipes communicate with and rise two inches into a cylindrical tube, fixed horizontally for the whole length of and about three feet above the boiler, with a slight inclination from one end to the other. At the end which is lowest it communicates with a coil or worm pipe, having an interior surface not less in superficial area than
10 the exterior of the drying chamber, which coil or worm pipe, together with the horizontal cylindrical tube, is laid in a brick-built chamber cemented inside, and containing cold water, and through which cold water is continually running.

The coil or worm pipe communicates with a hermetically closed
15 chamber, constructed underground, and cemented inside, called the distillate chamber.

The distillate chamber has a pumping apparatus fixed in connection with it, and it has a small air pipe passing from the interior through the top and communicating with the purifying cistern constructed on the
20 top of the emptying chamber herein-after described.

At any convenient spot immediately contiguous to the distillate chamber, or a distance from it, I construct another closed chamber, in which I arrange and construct two washing or saturating cisterns, working alternately, and a filtering and purifying medium, consisting of five sec-
25 tional chambers. The pumping apparatus before described, in connection with the distillate chamber, communicates by underground pipes, or by hermetically closed pipes above ground with the washing and saturating beds inside the last-mentioned chamber.

Returning to the drying chamber I construct at the end where the
30 door for emptying is arranged and above ground another closed chamber, called the emptying chamber. This chamber has in the floor an iron trap door communicating with a tunnel, in which is an underground rail or tramway, furnished with a covered waggon on four wheels. It has also an air pipe running from the interior through the top, and com-
35 municating with the purifying cistern built thereon.

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The process of drying the excreta, treating the gases, and purifying the distillate with the before-mentioned apparatus is as follows:—

When the solid and fluid excretæ is received in the stowage chamber it is mixed and thoroughly incorporated with sulphate of lime, sulphate of magnesia, chloride of calcium, chloride of manganese, or other agent 5 for holding the ammonia during the process of drying. It is then conveyed by the feed pipe to the drying chamber.

During the process of mixing the gases generated (if any) pass by the vapour pipe to the purifying cistern erected on the top. The excreta is conveyed by the feed pipe to the drying chamber at intervals to suit the 10 convenience of working. The boiler is partly filled with water, and heated by the fire to 212° Fahrenheit.

It having previously been ascertained to what degree of temperature the agent which has been used for fixing the ammonia in the excreta will safely hold it, the water and steam in the boiler are further heated 15 and kept up to such temperature which may vary from 212° to 395° Fahrenheit. Any temperature greatly in excess of that heat I consider may possibly decompose or impair some of the organic or inorganic constituents of the manure.

During the process of drying the excreta is kept in motion by the 20 agitator fixed in the drying chamber, and the vapours generated are conveyed by the three steam ascension pipes to the horizontal pipe, where condensation begins to take place. The steam then traverses the coil or worm pipe, which has an internal superficial area not less than the external surface of the drying chamber, until it discharges itself as 25 condensed vapour or distillate into the distillate chamber.

As the distillate rises in the chamber the displaced air makes its exit through the air pipe at the top into the purifying cistern constructed thereon, which is charged with the same purifying substances as the cistern on the top of the stowage chamber. 30

The distillate is pumped at intervals by the pumping apparatus from the distillate chamber through the hermetically closed pipes into the washing and saturating chambers, and there mixed and thoroughly worked with lime. After settling it is allowed to run quietly off through the filtering and purifying medium, and is conveyed by aqueducts to an 35 adjoining canal or watercourse.

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The excreta when dried to a powder is taken from the drying chamber through the door provided for the purpose into the emptying chamber, where it may or may not be "bagged up," let down into the waggon on the underground railway, and conveyed to the receiving rooms erected
5 at another part of the works.

SPECIFICATION in pursuance of the conditions of the Letters Patent, filed by the said William White Fereday in the Great Seal Patent Office on the 21st June 1873.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, WILLIAM
10 **WHITE FEREDAY**, of No. 5, Falmouth Road, Dover Road, in the County of Surrey, Civil Engineer, send greeting.

WHEREAS Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Twenty-first day of December, in the year of our Lord One thousand eight hundred and seventy-two, in the thirty-
15 sixth year of Her reign, did, for Herself, Her heirs and successors, give and grant unto me, the said William White Fereday, Her special license that I, the said William White Fereday, my executors, administrators, and assigns, or such others as I, the said William White Fereday, my executors, administrators, and assigns, should at any time
20 agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an Invention for "IMPROVEMENTS IN TREATING HUMAN EXCRETA, AND IN APPARATUS FOR WORKING
25 THE EXCRETA AND CONVERTING THE SAME INTO A DRY AND HIGHLY CONCENTRATED MANURE," upon the condition (amongst others) that I, the said William White Fereday, my executors or administrators, by an instrument in writing under my, or their, or one of their hands and seals, should particularly describe and ascertain the nature of the said
30 Invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said Letters Patent.

NOW KNOW YE, that I, the said William White Fereday, do
35 hereby declare the nature of the said Invention, and in what manner

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the same is to be performed, to be particularly described and ascertained in and by the following statement thereof, that is to say :—

This Invention has for its object improvements in treating human excreta, and in apparatus for working the excreta and converting the same into a dry and highly concentrated manure. 5

The solid and fluid excreta as they accumulate I treat from time to time with such deodorants, being ammonia fixers, as are suited to the fertilizing purposes of the manure, and the organism and development of plants.

The apparatus which I have designed is for the purpose of manufac- 10
turing the prepared solid and fluid excreta into a dry portable manure, having all the fertilizing powers which the bulk had before being reduced. It consists of a brick-built cemented chamber, called the stowage chamber, shewn at Figures 1 and 2 of the Drawings hereunto annexed. Figure 1 shews a ground plan of the apparatus, and Figure 2 15
a section on the line C, A, D, Figure 1. The stowage chamber is fixed at such a level as will admit of the vehicles which convey the collected excreta depositing their contents through a shoot into it. On the top is constructed a brick, lead, or iron purifying or disinfecting chamber, see Figure 2, to receive charcoal or any other substance or matter being 20
an absorbent or destructive agent. Through the bottom a small pipe discharges any rain water which the cistern may receive, and there is a vapours ascension pipe rising three inches above the bottom, having its outlet into it, and communicating with the stowage chamber. There is also a junction for a feed pipe fitted with a valve or cock near the bottom 25
of the stowage chamber, which when the feed pipe is attached communicates with the drying or evaporating chamber.

The drying or evaporating chamber is a stationary wrought-iron chamber, constructed and permanently fixed inside a stationary wrought-iron boiler, built and encased in fire-brick. The evaporating chamber is. 30
seen at Figure 3, which represents the apparatus partly in elevation and partly in section on the line A, B, Figure 1. A cross section of the evaporating chamber is shewn at Figure 4, the section being taken on the line E, F, Figure 3. An elevation of the front end of the evaporating chamber is also shewn at Figure 5, and an elevation of the opposite end 35
of the drying apparatus, which is inside the emptying chamber, is shewn at Figure 6. A plan of the evaporating chamber, shewing the position of the steam pipes, is given at Figure 7.

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The boiler is fitted with a safety valve, steam gauge, water indicator, supply and waste pipes for steam and water, and such other appliances as may be necessary to fit the same as a perfect steam boiler.

The boiler has one or more fire-grates, and the evaporating chamber
5 at its end furthest from the fire-place or places is not inclosed within the boiler, but is exposed, and in it is a doorway for emptying the contents of the chamber when dried into the emptying chamber, see Figures 1 and 3. The doorway is fitted with a loose hanging door, as shewn at Figure 6, which during the process of drying is closely and securely bolted down
10 on to a finely-tempered clay luting flush with the furnace end. It has a feed pipe and a tube to admit an instrument for testing from time to time the drying of the contents of the chamber; also three steam ascension pipes of large dimensions, one in the middle and one near to each end, all of which rise from its top and pass through the top of the
15 boiler. The feed pipe communicates with the stowage chamber, as shewn at Figure 1.

The tube to admit the testing instrument rises a few inches above the outside of the boiler, and is fitted with a screw cap. It has as well an agitator or stirrer fixed along its centre, extending from end to end, as
20 shewn at Figure 3, which is kept continually in motion by steam power.

The three steam ascension pipes communicate with and rise two inches into a cylindrical tube, as shewn at Figures 4 and 7, fixed horizontally for the whole length of and about three feet above the boiler, with a
25 slight inclination from one end to the other. At the end which is lowest it communicates with a coil or worm pipe, shewn at Figure 2, having an interior surface not less in superficial area than the exterior of the drying or evaporating chamber, which coil or worm pipe is laid in a brick-built chamber, cemented inside, and containing cold water, and through which
30 cold water is continually running.

The coil or worm pipe communicates with a hermetically closed chamber, constructed underground, and cemented inside, called the distillate chamber, see Figure 2.

The distillate chamber has a pumping apparatus fixed in connexion
35 with it, to convey the distillate into either one or other of the saturating beds 1, 2, shewn at Figure 1. These saturating beds may be worked alternately or both together, and are by preference filled with lime.

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The distillate as it flows from the saturating beds passes into a filtering chamber divided into sections, each section being filled with filtering materials, by preference charcoal, and the distillate being caused to filter upwards in succession through the filtering material in all the sections.

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The emptying chamber and the distillate chamber herein-before mentioned form the base of a tall chimney, as shewn at Figure 3.

To facilitate the evaporating process an air pump may be used to reduce the pressure in the evaporating chamber at the commencement of drying each charge.

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The process of drying the excreta, treating the gases, and purifying the distillate with the before-mentioned apparatus is as follows :—

When the solid and fluid excreta is received in the stowage chamber it is mixed and thoroughly incorporated with sulphate of lime, sulphate of magnesia, chloride of calcium, chloride of manganese, or other agent 15 for holding the ammonia during the process of drying. It is then conveyed by the feed pipe to the drying chamber.

During the process of mixing, the gases generated (if any) pass by the vapour pipe to the disinfecting chamber or purifying cistern erected on the top. The excreta is conveyed by the feed pipe to the drying or 20 evaporating chamber at intervals to suit the convenience of working. The boiler is partly filled with water, and heated by the fire to 212° Fahrenheit.

It having previously been ascertained to what degree of temperature the agent which has been used for fixing the ammonia in the excreta 25 will safely hold it, the water and steam in the boiler are further heated, and kept up to such temperature which may vary from 212° to 395° Fahrenheit. Any temperature greatly in excess of that heat I consider may possibly decompose or impair some of the organic or inorganic constituents of the manure.

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During the process of drying the excreta is kept in motion by the agitator fixed in the drying chamber, and the vapours generated are conveyed by the three steam ascension pipes to the horizontal pipe, where condensation begins to take place. The steam then traverses the coil or worm pipe, which has an internal superficial area not less 35

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than the external surface of the drying chamber, until it discharges itself as condensed vapour or distillate into the distillate chamber.

As the distillate rises in the chamber the displaced air makes its exit through an air pipe at the top into the chimney shaft.

5 The distillate is pumped at intervals by the pumping apparatus from the distillate chamber through the hermetically closed pipes into the washing and saturating chambers, and there mixed and thoroughly worked with lime. After settling it is allowed to run quietly off through the filtering and purifying medium, and is conveyed by aqueducts to an
10 adjoining canal or watercourse.

The excreta when dried to a powder is taken from the drying chamber through the door provided for the purpose into the emptying chamber, where it may be "bagged up" and conveyed to the receiving rooms erected at any desired part of the works.

15 Having thus described the nature of my Invention, and the manner of performing the same, I would state that I claim,—

1. The combined arrangement, substantially as herein described, of apparatus for treating human excreta, and converting the same into a dry and highly concentrated manure.

20 2. The employment for evaporating off moisture from human excreta, of an evaporating chamber encased and heated as herein-described by a steam boiler under pressure, and containing an agitator for stirring the matters as they are being dried.

In witness whereof, I, the said William White Fereday, have
25 hereunto set my hand and seal, this Nineteenth day of June, in the year of our Lord One thousand eight hundred and seventy-three.

WILL. W. FEREDAY. (L.S.)

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